NIA Project Registration and PEA Document

Date of Submission

Jan 2019

Project Reference Number

NIA_UKPN0045

Project Registration

Project Title

Shift

Project Reference Number

NIA_UKPN0045

Project Licensee(s)

UK Power Networks

Project Start

January 2019

Project Duration

2 years and 10 months

Nominated Project Contact(s)

Evie Trolove

Project Budget

£1,295,500.00

Summary

Electric vehicle (EV) uptake is set to surge, and to enable this we must either reinforce the network or will need customers to be flexible around when they charge their cars. Indicatively, without flexible arrangements, we expect to see peak demand growing approximately up to 10% at secondary substations by the end of RIIO-ED1 and up to 30% by the end of the 2030s. This is based on the load impact analysis done at Recharge the Future project at primary substation level, which was then translated into secondary substation level. The majority of this growth will be driven by the uptake of EVs connecting to the LV network. This is an unprecedented pace of growth that will require a step-change in the way we manage the LV network. In the absence of smart solutions, this growth in demand will trigger the need for reinforcement on the network which will be paid by network customers.

UK Power Networks is strategically looking at procuring flexibility as alternative to traditional reinforcement and is adopting a 'flexibility first' approach to delivering additional network capacity, which will lead to lower costs and increased renewable energy on the network through more competition. In this context, UK Power Networks has a key role in stimulating the market for flexible services and helping to reduce customers' bills.

Specifically, smart charging of EVs has the potential to unlock flexibility at LV level, therefore deferring a proportion of the required reinforcement associated with the uptake of EVs. UK Power Networks' project Smart Charging Architecture Roadmap (SmartCAR) has developed feasible designs for market-led smart charging. However, this has not yet been demonstrated in practice, therefore it is now the time to engage with the market and mobilise trials to explore how these designs will work in reality, and to deploy the smart solutions required on network level to enable smart charging.

Nominated Contact Email Address(es)

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Problem Being Solved

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flexible around when they charge their cars. Indicatively, without flexible arrangements, we expect to see peak demand growing approximately up to 10% at secondary substations by the end of RIIO-ED1 and up to 30% by the end of the 2030s. This is based on the load impact analysis done at Recharge the Future project at primary substation level, which was then translated into secondary substation level. The majority of this growth will be driven by the uptake of EVs connecting to the LV network. This is an unprecedented pace of growth that will require a step-change in the way we manage the LV network. In the absence of smart solutions, this growth in demand will trigger the need for reinforcement on the network which will be paid by network customers.

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Method(s)

Smart charging has the potential to unlock flexibility that will help defer reinforcement. The SmartCAR project has shown that market led approaches to smart charging have the ability to provide the necessary response to network needs. This project will investigate how market led approaches can work in practise and specifically, how DNOs can enable the market to manage smart charging in response to price signals.

Since the preliminary CBA for Shift was delivered in 2019, a separate UK Power Networks project to deliver a more advanced forecasting tool was commenced and this is now nearing completion. The tool will be capable of modelling the impact of electric vehicles and smart charging on the LV network and will more accurately assess the potential for smart charging to address LV constraints than the original approach proposed for Shift. As well as develop inputs to the forecasting tool, Shift will carry out analysis to compare the three mechanisms trialled.

The Shift project duration has been extended by six months so the newly developed forecasting tool can be used for the Shift CBA which will lead to more robust results. Shift will be responsible for developing inputs into the forecasting tool. Analysis originally planned to assess and compare the three mechanisms trialled will continue as planned. To account for the more efficient approach to the CBA, a greater focus will be given to assessing the customer behaviour and the impact of coronavirus. The project extention can be accomodated within the existing Shift project budget.

Scope

Smart Charging Market Trials will run trials to investigate market-led approaches to smart charging, identified through SmartCAR project. These could include for example:

1. Price-based mechanisms (ToU DUoS bundled together with capacity prices)
2. Procurement mechanisms (Flexibility procurement bundled together with third party load management)

UK Power Networks will engage and work with project partners to develop customer propositions that deliver against network needs, and design and implement the commercial, technical and regulatory mechanisms required to support them. Structured trial phases will then be carried out to develop reliable datasets that can be used to inform industry decision making. Learning will be disseminated via reports and engagement events/meetings.

Objective(s)

This project aims to:

1. Stimulate the development of market-led smart charging solutions, working with market participants to develop, enable and trial attractive customer propositions

2. Develop and test processes, systems components and commercial arrangements to enable these propositions

3. Understand customer response to the designed propositions and network impacts in a controlled environment

4. Develop a scalable solution that can be expanded to a larger volume of customers and drive benefit ahead of regulatory reforms, and

5. Inform Ofgem's longer-term access and network charging reform.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The delivery of the following outcomes will be considered when assessing whether the project has been successful:

1. Insights into the value of LV constraint flexibility

2. A workable smart charging approach and evidence to support industry decisions regarding the way forward for Great Britain (GB) – including technical detail such as engineering standards

3. Evidence that price signals from Distribution Network Operators (DNOs) can be used to facilitate smart charging, and EV charging response can be provided by the market to manage network constraints

4. Insights to support the industry to make decisions regarding the appropriate future form of smart charging in GB

Project Partners and External Funding

The project will be carried out with support from Baringa Partners. No external funding.

Potential for New Learning

Through completion of this project the following learnings are expected:

· Deeper understanding of:

- The value/potential of smart charging to provide LV flexibility
- The investment case for DNOs to procure flexibility from smart charging as alternative to LV reinforcement
- The LV flexibility market including the liquidity of the market, the speed of take up and scale of flexibility products

· Insights into:

- What changes are required to current regulatory framework to accommodate market-led smart charging solutions
- What new systems or system updates are required to accommodate market-led smart charging solutions
- The creation of a smart charging standard

· Evidence around LV flexibility and customers' acceptance of allowing third party control of their assets

Scale of Project

The project seeks to test different smart charging market mechanisms and as such more than one trial is required to run in parallel. The scale of the project is also defined by the work required to develop new suitable customer proposition and innovative commercial arrangements. While all market stakeholders agree that a market-led approach to smart charging is favorable, they cannot pick a single market mechanism as the most appropriate one at this stage. As such, and since LV flexibility products and a market-led approach to smart charging providing flexibility to DNOs are at their infancy, a smaller scale will not be suitable to stimulate the market and gather enough evidence to inform future decisions.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

The project will be carried out across all three of UK Power Networks licence areas; Eastern Power Networks, South Eastern Power Networks and London Power Networks.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£1,295,500

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

n/a

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

SSEN's project "My Electric Avenue" has demonstrated that through solutions that allow the DNO to influence EV charging, GB DNOs could save £2.2billion by 2050 by avoiding network reinforcement.

This project is looking at different smart charging operating models to produce recommendations for GB DNOs on an economically, socially and technically preferred option. Part of the project will look at developing cost-benefit analysis models to inform no-regrets investments for DNOs for implementing smart charging smart solutions as part of their flexibility portfolio. This will help DNOs manage the uptake of EVs at the lowest possible cost.

By enabling a smart charging market, the benefits from deferred reinforcement throughout the remainder of ED1 period, are estimated to be up to £13.2m in UK Power Networks' licensee areas.

Please provide a calculation of the expected benefits the Solution

Deferred cost through smart charging across UK Power Networks licensee areas (benefits) till end of ED1 = £26m
Method cost (trials) = £1.3m
Method cost (roll-out) = £12m

Net benefits (=Deferred cost – Method Cost (trials) – Method cost(Roll-out)) = £26m – £1.3m – £12m = £13.2m

Please provide an estimate of how replicable the Method is across GB

By 2030, it is projected that there will be at least 6 million* EVs in the UK, with the potential to offer significant flexible services to alleviate local network constraints across the country.

*Element Energy, UK EV uptake, 2010, Extended Scenario projection
http://www.element-energy.co.uk/wordpress/wp-content/uploads/2012/05/EVs-in-the-UK-and-ROI_final-report_10.12.10.pdf

Please provide an outline of the costs of rolling out the Method across GB.

The costs of rolling out the Method across GB is estimated to be £45.4m.

Notes:

• This excludes the costs associated with the trial in terms of resources and Minimum Viable Product (MVP) systems.

• A scale-up factor from UKPN to GB was used to reflect the UKPN method cost to a GB level. This scale-up factor was calculated based on peak demand proportion, i.e. comparing UKPN peak demand to GB peak demand.

• This assumes that EV uptake will affect other DNOs at the same rate as UK Power Networks. Although this is a crude assumption, this provides an indication of the potential costs of rolling out the solution across GB.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☐ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☑ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☑ A specific novel operational practice directly related to the operation of the Network Licensees system

☑ A specific novel commercial arrangement

RIIO-2 Projects

☐ A specific piece of new equipment (including monitoring, control and communications systems and software)

☐ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven

☐ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

n/a

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

This project contributes to addressing the 'Low Carbon Ready' challenge identified as one of the three key areas of focus in the UK Power Networks' Innovation Strategy. The Low Carbon Ready pillar looks at facilitating the uptake of low carbon technologies through smart solutions that reduce time and costs to connect low carbon load, generation and storage to the distribution network. In addition, this project sits under the umbrella of UK Power Networks' EV Strategy and more specifically under the "Network Readiness" category. This category investigates traditional and smart solutions (including smart charging) that ensure the distribution network can accommodate the increasing load associated with the uptake of EVs.

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects

already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

A number of GB projects have been carried out or are underway examining aspects of smart EV charging. Each of these projects have focussed on aspects of smart charging solutions, such as the link between charging points and substations and are progressing solutions in the context of a DNO-led intervention to protect local LV networks at risk of overload (a specific use-case is an "interim" solution to manage EV uptake in the short-term). The trial findings have been recognised from these projects, in particular Electric Nation[1] and Smart EV[2], and these will continue to inform such smart charging technical solutions. This project seeks to stimulate the development of market-led smart charging solutions, something that has not been demonstrated before, by working with market participants to develop, enable and trial attractive customer propositions as well as develop and test processes, systems components and commercial arrangements to enable these propositions.

UK Power Networks have been recently awarded NIC funding for their project Optimise Prime. Market-led approaches to residential smart charging are not in scope for Optimise Prime. Moreover, the charging segments targeted in this project and Optimise Prime are different: while Optimise Prime is focusing on fleets and commercial EV charging, this project is targeting residential EV charging and LV flexibility.

[1] http://www.electricnation.org.uk/
[2] https://www.eatechnology.com/engineering-projects/smart-ev/

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

As described above, the purpose of this work is broader in nature than similar work being carried out by Scottish and Southern Energy Networks (SSEN) and Western Power Distribution (WPD) in collaboration with EA Technology. While the projects undertaken by SSEN and WPD focus on solutions in the context of a DNO-led intervention to protect local LV networks, this project will mobilise trials to investigate new forms of residential smart charging – in which the DNO enables the market to manage smart charging in response to price signals.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

Smart charging trials to date in the UK have been focused on an interim solution of a DNO-led intervention to protect LV networks at risk of overload due to increasing EV connections. These projects have not investigated a longer-term solution due to the pressing need for progress on the interim solution, and also due to the fact that various critical wider industry questions are still unanswered. The SmartCAR NIA project has developed feasible designs for market-led smart charging. However, this has not yet been demonstrated in practice, therefore it is now the time to engage with the market and mobilise trials to explore how these designs will work in reality, and to deploy the smart solutions required on network level to enable smart charging.

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

There is currently no consensus regarding the evolution of the smart charging landscape, and there will be significant work and engagement required to move things forward. Smart CAR's proposed market mechanisms have not been tested in the past and they are still unproven thus the risk of success remains. These will need to be tested and proved effective to deliver smart charging services to networks in a trial environment in order to produce the evidence required for further roll-out. Furthermore, there is high level of uncertainty whether there is enough liquidity at LV network level for securing a flexibility response to network needs and deploy the solution as a solid alternative to network reinforcement. In this case it is therefore appropriate to use NIA funding to advance the solution at this stage.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

This project, as noted above, yields uncertain commercial returns. In addition, enabling a smart charging market that can effectively provide flexibility services to respond to network needs carries significant operational and technical challenges. Finally, this project seeks to inform Ofgem's longer-term access and network charging reforms and as such it carries risks that are regulatory related.

This project has been approved by a senior member of staff

☑ Yes